

WHAT IS CLAIMED IS:

1. A nitride semiconductor light emitting element, comprising:
  - a substrate;
  - a lower clad layer formed of a nitride semiconductor containing Al and Ga stacked thereon;
  - 5 a lower guide layer formed of a nitride semiconductor mainly containing In and Ga stacked thereon; and
  - an active layer including a nitride semiconductor mainly containing In and Ga stacked thereon; wherein
  - said lower guide layer has a first layer and a second layer higher in  
10 In content than said first layer, successively stacked from the active layer side.
2. The nitride semiconductor light emitting element according to claim 1, wherein  
 $L_1 \geq 20\text{nm}$ ,  
wherein  $L_1$  is a distance from said second layer to a well layer at the  
5 substrate side in said active layer.
3. The nitride semiconductor light emitting element according to claim 1, wherein  
said active layer is a quantum well active layer, wherein  
 $\text{In}_{(x)2} - 0.10 \leq \text{In}_{(x)0} \leq \text{In}_{(x)2} + 0.10$   
5 wherein  $\text{In}_{(x)2}$  is In content of said second layer and  $\text{In}_{(x)0}$  is In content of a well layer in said active layer.
4. The nitride semiconductor light emitting element according to claim 1, wherein  
said first layer is lower in In content than a well layer in said active layer.
5. The nitride semiconductor light emitting element according to

claim 1, wherein

said lower guide layer has a first layer, a second layer and a third layer lower in In content than said second layer, successively stacked from the active layer side.

6. The nitride semiconductor light emitting element according to claim 5, wherein

said third layer has a fourth layer higher in In content than said third layer.

7. The nitride semiconductor light emitting element according to claim 1, wherein

said second layer is a multiple quantum well layer, wherein  
 $In_{(x)2'} - 0.10 \leq In_{(x)0} \leq In_{(x)2'} + 0.10$

wherein  $In_{(x)2'}$  is In content of a well layer in said second layer and  $In_{(x)0}$  is In content of a well layer in said active layer.

8. The nitride semiconductor light emitting element according to claim 1, further comprising

a seventh layer formed of a nitride semiconductor mainly containing In and Ga on and adjacent to said active layer.

9. The nitride semiconductor light emitting element according to claim 1, wherein

said second layer functions as a saturable absorption layer.

10. The nitride semiconductor light emitting element according to claim 9, wherein

said lower guide layer has a first layer, a second layer, and a third layer lower in In content than said second layer, successively stacked from the active layer side.

11. The nitride semiconductor light emitting element according to

claim 10, wherein

$0\text{nm} \leq L_3 \leq 20\text{nm}$ ,

wherein  $L_3$  is a thickness of said third layer.

12. The nitride semiconductor light emitting element according to claim 10, wherein

said third layer has a fourth layer higher in In content than said third layer.

13. The nitride semiconductor light emitting element according to claim 12, wherein

said fourth layer functions as a saturable absorption layer.

14. The nitride semiconductor light emitting element according to claim 12, wherein

said second layer and said fourth layer are different in impurity concentration.

15. The nitride semiconductor light emitting element according to claim 9, wherein

$L_1 \geq 20\text{nm}$ ,

5       wherein  $L_1$  is a distance from said second layer to a well layer at the substrate side in said active layer.

16. The nitride semiconductor light emitting element according to claim 9, wherein

$0.5\text{nm} \leq L_2 \leq 5.0\text{nm}$ ,

wherein  $L_2$  is a thickness of said second layer.

17. The nitride semiconductor light emitting element according to claim 9, wherein

said first layer is greater in substantial bandgap than said active layer.

18. The nitride semiconductor light emitting element according to claim 9, wherein

said active layer is a quantum well active layer, wherein  
 $Eg_2 - 0.02\text{eV} \leq Eg_0 \leq Eg_2 + 0.15\text{eV}$ , and

5            $In_{(x)2} - 0.10 \leq In_{(x)0} \leq In_{(x)2} + 0.10$ ,

wherein  $In_{(x)2}$  is In content of said second layer,  $Eg_2$  is substantial bandgap of said second layer,  $In_{(x)0}$  is In content of said active layer, and  $Eg_0$  is substantial bandgap of said active layer.

19. The nitride semiconductor light emitting element according to claim 9, wherein

said second layer is a multiple quantum well.

20. The nitride semiconductor light emitting element according to claim 19, wherein

$Eg_2' - 0.02\text{eV} \leq Eg_0 \leq Eg_2' + 0.15\text{eV}$ , and  
 $In_{(x)2}' - 0.10 \leq In_{(x)0} \leq In_{(x)2}' + 0.10$ ,

5           wherein  $Eg_2'$  is substantial bandgap of said second layer,  $In_{(x)2}'$  is In content of a well layer in said second layer,  $In_{(x)0}$  is In content of said active layer, and  $Eg_0$  is substantial bandgap of said active layer.

21. The nitride semiconductor light emitting element according to claim 19, wherein

$0.5\text{nm} \leq L_2' \leq 5.0\text{nm}$ ,

5           wherein  $L_2'$  is a thickness of one well layer in said second layer of a multiple quantum well.

22. The nitride semiconductor light emitting element according to claim 9, further comprising

a fifth layer and a sixth layer successively stacked from the active layer side between said first layer and said second layer, wherein

5           said fifth layer is higher in In content than said first layer, and said sixth layer is lower in In content than said fifth layer and said second layer.

23. The nitride semiconductor light emitting element according to claim 22, wherein

$L_5 \geq 20\text{nm}$ ,

5 wherein  $L_5$  is a distance from said fifth layer to a well layer at the substrate side in said active layer.

24. The nitride semiconductor light emitting element according to claim 22, wherein

said second layer and said fifth layer are different in impurity concentration.

25. The nitride semiconductor light emitting element according to claim 9, further comprising

a seventh layer formed of a nitride semiconductor mainly containing In and Ga on and adjacent to said active layer.

26. A method for manufacturing a nitride semiconductor light emitting element including a substrate, a lower clad layer formed of a nitride semiconductor containing Al and Ga stacked thereon, a lower guide layer formed of a nitride semiconductor mainly containing In and Ga stacked thereon, and an active layer including a nitride semiconductor mainly containing In and Ga stacked thereon, said lower guide layer having a first layer and a second layer higher in In content than said first layer successively stacked from the active layer side, wherein

5  $\Delta T \leq 80^\circ\text{C}$ ,

10 wherein  $\Delta T$  is variation in growth temperature from initiation of growth of said lower guide layer to initiation of growth of said active layer.

27. A method for manufacturing a nitride semiconductor light emitting element including a substrate, a lower clad layer formed of a nitride semiconductor containing Al and Ga stacked thereon, a lower guide layer formed of a nitride semiconductor mainly containing In and Ga stacked thereon, and an active layer including a nitride semiconductor

mainly containing In and Ga stacked thereon, said lower guide layer having a first layer and a second layer higher in In content than said first layer successively stacked from the active layer side, wherein

10 growth temperature of each layer from initiation of growth of said lower guide layer to initiation of growth of said active layer is at most 830°C.

28. A method for manufacturing a nitride semiconductor light emitting element including a substrate, a lower clad layer formed of a nitride semiconductor containing Al and Ga stacked thereon, a lower guide layer formed of a nitride semiconductor mainly containing In and Ga  
5 stacked thereon, and an active layer including a nitride semiconductor mainly containing In and Ga stacked thereon, said lower guide layer having a first layer, a second layer higher in In content than said first layer and functioning as a saturable absorption layer, and a third layer lower in In content than said second layer successively stacked from the active layer side, said third layer having a fourth layer higher in In content than said 10 third layer, wherein

$$T_4 \leq T_2,$$

wherein  $T_2$  is growth temperature of said second layer and  $T_4$  is growth temperature of said fourth layer.

29. A method for manufacturing a nitride semiconductor light emitting element including a substrate, a lower clad layer formed of a nitride semiconductor containing Al and Ga stacked thereon, a lower guide layer formed of a nitride semiconductor mainly containing In and Ga  
5 stacked thereon, and an active layer including a nitride semiconductor mainly containing In and Ga stacked thereon, said lower guide layer having a first layer and a second layer higher in In content than said first layer and functioning as a saturable absorption layer successively stacked from the active layer side, said lower guide layer further having a fifth layer and a 10 sixth layer successively stacked from the active layer side between said first layer and said second layer, said fifth layer being higher in In content than said first layer, and said sixth layer being lower in In content than said fifth

layer and said second layer, wherein

$$T_5 \leq T_2,$$

- 15       wherein  $T_2$  is growth temperature of said second layer and  $T_5$  is  
growth temperature of said fifth layer.

30. A method for manufacturing a nitride semiconductor light emitting element including a substrate, a lower clad layer formed of a nitride semiconductor containing Al and Ga stacked thereon, a lower guide layer formed of a nitride semiconductor mainly containing In and Ga  
5       stacked thereon, and an active layer including a nitride semiconductor mainly containing In and Ga stacked thereon, said lower guide layer having a first layer and a second layer higher in In content than said first layer and functioning as a saturable absorption layer successively stacked from the active layer side, wherein

- 10       at least one interface at which growth interruption is introduced is located in a range of  
                 $0\text{nm} \leq L_4 \leq 20\text{nm}$ ,  
                wherein  $L_4$  is a distance between said interface and the second layer.

31. The method for manufacturing a nitride semiconductor light emitting element according to claim 30, wherein

temperature variation of said substrate occurs at least once during said growth interruption.